

Notes

on the Modes of Operating in the M. & R. Office Refinery, Melting Rooms, &c.

P. 4. The chief difference in our practice is, that the Register is supposed to represent the M. & R. and makes entries of weights before & after melting, and ~~dis-~~
~~usses~~ calculates the pr. ct. loss in melting each deposit. The M. & R. ~~weekly~~ discusses the losses in weekly groupings of deposits.

The M & R. has otherwise nothing to do with the Deposits, and, on sound principles, should not have, until they are officially delivered to him, when he becomes responsible for the Bullion; except that he advises how to melt the deposits, when called on to do so. Mr. H. Cochran, the Receiving Clerk can state what the practice is, with deposits, until they are passed into the M & R's hands.

The smaller deposits ^{being ~~few~~ ^{small} in number & weight} are ~~passed~~ allowed to accumulate, usually, ^{until the close of the} ~~for a~~ month before they are transferred to the M & R. The large deposits are transferred to the M & R. as fast as received when he has ~~a~~ vault-room to receive them. It frequently

It frequently happens that with the present heavy ² silver receipts, for lack of vault room by the M. & R., the large silver bars are weighed ^{of} debited to the M. & R., ^{to be taken out when required to melt for coinage} but put back into the Suptdt's vault. The chief object ^{in this hasty weighing} ~~being to receiving~~ Deposits close out an invoice of silver as soon as practicable, in order to make official returns of value to the party ^{whom} from any special lot may have been received.

Receiving Deposits } When Deposits or Purchases, or Transfers are passed by the Suptdt. to the M. & R. they are usually ^{the M. & R., or their delegates, and} passed in groups, the Receiving Clerk, ~~or his Assistant,~~ the Register, ~~and the M. & R. or Assist. M. & R.,~~ each ~~one~~ ^{of each draft} noting the weight separately, & ~~and~~ ^{the Receiving} after that, ~~one~~ ^{clerk} ~~of them~~ calling out the weight, to which the others respond affirmatively or negatively, as they agree or otherwise. Every weight so taken is entered in ^{their several} ~~different~~ books by each of the three persons weighing, and after a series of weighings, the whole lists are compared by one reading atoud (the noted weights). In the case of refined silver bars, ~~now so~~ now so ^{properly} ~~extensively~~ brought supplied to this Mint, each bar of 800 oz. @ 1800 oz. is separately weighed, & the weight entered

entered into the books of the 3 weighers, as above.
 When they have to be left in the Suptdt's vault, as above
 stated, consecutive numbers are marked on each bar,
~~by~~ which they are entered in the M & R's book of
 weighings, as well as by the N^{os} stamped on the bars,
 by the Deposit N^o of the Mint, thereby insuring identity.

The M & R. gives to ^{the Suptdt.} ~~the~~ receiving clerk a
 Receipt for the Gross weight of bullion received,
 usually for each Invoice by itself; and for the
 smaller deposits of the Month at the beginning
 of the ~~Month~~ next Month, as soon as their value
 is ascertained by Assay.

While the M & R. receives the Bullion in gross,
 he is debited with its Standard Weight, calculated from
 the Gross weight & the Assay, by two Suptdt's Clerks, sepa-
 rately, ~~by~~ different methods. The M & R. has not official
 force sufficient to calculate ~~the~~ the Standard weights of
 Deposits, as they are received, and must perforce accept
 the calculations of those ~~two~~ clerks as absolute truth.

Refining Gold

by Acid,

Our own Deposits of Gold are all refined, except
 those of merely melted coin, which are selected from
 the rest, to be melted alone. The other deposits ^{varying} ~~at~~ frequently

varying from 5 oz. to 1000 oz. each in weight, are assorted in lots according to each range of 100 ~~oz~~ from 900 fineness down to 300, which last includes all deposits below 300. ~~This~~ This last lot ~~is~~ is worked alone, no silver being added to it, because it contains a sufficient quantity. To each of the other six lots, from 400 to 900, silver is added in such ^{quantities} ~~proportion~~, that the proportion of silver (~~or other met~~ including copper, &c) is to gold as about 2 to 1. Each of these lots is melted, & granulated by being cast into cold water. ~~The~~ The granulations are boiled in pure nitric acid until nearly all the silver is extracted, & ~~then~~ ^{then} further refined by hot sulphuric acid. The solutions of silver are entirely precipitated by common salt, and the resulting chloride of silver is reduced to metallic silver by granulated zinc. The reduced silver is washed, dried by a low red heat, & melted ^{into} ~~into~~ silver ^{bars} of 998 @ 999 $\frac{1}{2}$ fineness.

The fine Gold from which all the silver ^{solutions} ~~have~~ been washed out, is dried at a low red heat, melted, & cast into bars of 995 @ 999 fineness.

Refining Silver

Refining Silver

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Good silver of 900 fineness is directly melted into Ingots for coin; Fine silver, ~~is~~ mixed with its due proportion of copper is similarly treated. All other silver, unless manifestly tough & adapted to coinage, is refined by acid. Such silver is cast into bars of about 200 oz. in the Deposit-melting Room, prior to their delivery to the M & R. These bars are boiled with pure nitric acid, the clear solution of silver raked off from ~~the~~ possible residue (^{& separately worked for} often containing gold) precipitated by salt, & ^{washed} the chloride of silver reduced by granulated metallic zinc. The reduced ~~silver is~~ metallic silver is washed, dried, ~~and~~ melted & cast into bars of 998 @ 999 $\frac{1}{2}$ ~~fine~~, occasionally of 1000 fineness.

Making up Melts for ~~Gold~~ Ingots

In making up ^amelts for Ingots, whether gold or silver, about one half the amount of fine metal ^{usually} is taken, ~~because~~ ^{clippings} from previous workings, ^{received from the} ^{Boiner} ^{making} up the other half. ^{because} ~~since~~ experience shows that ^{such} clippings tend to ~~soften~~ & improve the quality of newly-made alloys, & make it softer than if the whole

if the whole melt were made up of fine ^{silver} metal ~~and copper~~ ~~the~~ with its due proportion of copper. Beside this advantage, clippings of standard metal ^{are charged into the metal} ~~put into the freshly~~ ~~melted metal, for when it is nearly all melted~~ ^{metal last of all} in order to moderate the heat of the alloy, & reduce it to the temperature best adapted to casting, as ~~determined by experience may~~

The bullion to be made into standard metal is weighed by ~~(who keeps an account of the weights)~~ ~~the Assistant Meltor & Refiner~~, put into a copper-lined box. The M & R., or the Assistant M & R., weighs out the due quantity of bullion ^{for a melt} to be made standard ^{into} ~~metal~~, notes the weight (twice read, by himself & by the weigher) in ~~the~~ in ~~book kept~~ ^{arranged} for the purpose, called ["]the Working Book["], and puts ~~the bullion~~ into a copper-lined box. He then ~~carefully~~ calculates accurately the amount of alloying copper or of fine metal, as the case may be, required to ^{bring each} ~~make the~~ melt ^{to} of standard fineness, ^{weighs it out,} and adds ^{box containing that} it to the melt. ~~A half dozen (more or less) of such melts are~~ ^{several} ~~are~~ ^{consecutively} ~~so weighed out at a time.~~

^{*} ~~over~~ In this case also a double reading of the weight is ~~resorted to~~ ^{practised} to insure greater accuracy. The single calculation of the ~~plan~~ quantity of copper or ~~of~~ fine metal, required to make standard, seems to be quite sufficient, for we have not found an error in 1000 melts.

when a can

To facilitate ~~the~~ weighing out the precise amount of Copper,
the best Copper Ingots (at present we employ those of Pope, Cole
& Co. of Baltimore) of 12 @ 15 lbs. weight are cast by us into
thinner ingots, some of which are ~~again cut~~ ^{sheared} into smaller
pieces, ~~and some are cast into water~~ ^{or they} ~~and~~ ^{the} to make fine granula-
tions of ~~shot~~ some ingots are cast into cold water to ^{is kept}
make shot of various sizes & weights. ^{A special} The account of
copper ^{used for} alloying for gold & silver is kept apart from that
used in the base coinage.

fine gold, next added. Experience has shown that the affinity of copper and gold for each other is a strong one, ^{their alloy} or but slowly, and scarcely liable to segregate into richer & poorer alloys; in a short space of time, ^{as I think from my experience,} except through the presence of small quantities of ~~foreign~~ ^{of some} other metals, ^{such} as antimony, & its sulphide, which ^{appear to} ~~I think~~ increase the tendency to segregation, and ^{except when melted in crucibles} without stirring.

To facilitate stirring the melted metals, I contrived a black lead paddle of convenient form, with a few holes ^{near} ~~thru at~~ the lower end, whereby the liquid metals ^{are} ~~is~~ divided into many streams, ~~and~~ whose increased surface of contact ^{between} the gold & copper, insured a more rapid & thorough ^{alloying} ~~blending~~. Experience confirms the ~~excellence of these~~ efficiency of ~~these~~ stirrers.

Powdered charcoal is continually kept on the surface of & to avoid loss by volatilization, the draft of the furnace is stopped off, so that the metal during melting & casting; The ingots coming hot from the moulds, are dipped for a few minutes in water acidulated with sulphuric acid, ^{whereby their surfaces are} ~~the~~ made clean & bright, then washed & cooled in cold flowing water. After ^{cutting off the} ~~having had their tops~~ or pouring gates cut off ~~(the being topped)~~ of ~~these~~ ingots, & filing ^{off} ~~the~~ feathered edges of ^{their} ~~its~~ sides, each ingot of a melt is stamped with ^{figures} ~~number~~ representing the assay number of ^{that} ~~the~~ melt from the beginning of the year.

Pieces are chipped ^{by the assayer} from the first & last ingot of each melt, respectively marked 1 & 2 of that melt, (and the

and the result of their assay determines ~~whether~~ whether they
 maybe delivered to the Suptdt. as of the proper fineness for
 coinage. ~~The minimum and maximum of fineness is rarely~~
~~As a general rule the fineness of our ingots~~
 outside of ~~varies between~~ 899.9 ^{stet} ~~and~~ 900.1, and our practice is never
 to allow a greater variation than from 899.7 to 900.3.

Making Silver Ingots

We usually ~~make up each~~ ^{cast from from each} melt of Standard ~~to~~ Silver
~~to 3000 @ 3200 ox.~~ about 3500 ox., which by topping
 & filing each ingot is reduced to 3000 @ 3300 ox. for the
 Dollar, ~~and rather less~~ ^{and rather less} ~~and or to 2700 ox.~~ for the quarter-dollar.

The melts are made in N^o 70 Black Lead Pots, ~~in a similar~~ ^{over N^o 2}
 The melts are treated similarly to those of ^{a part of} ~~manner to those of the~~ gold melts, the fine metal & all the copper
~~const~~ being first charged & melted, before the rest of the fine
 metal, ^{last of all} & clippings being ~~last~~ added. A slight covering of borax,
 which facilitates the fusion, & protects in a measure against vol-
 atilization, ^{is skimmed off,} when the fusion is complete & the metal well
 stirred, ^{melted} ~~the borax is skimmed off~~ & its total removal is more completely effected
 to which the remaining borax adheres, ~~which is wholly skimmed off~~ leaving a brilliant
 addition of a little fine charcoal, ~~It is~~ ^{so that both are more easily & completely} ~~the clean surface~~
~~of metallic silver.~~ The ^{immediately} ~~the melted~~ metal is then covered with fine charcoal,
 which is continually added during casting, and so that
 volatilizing waste is measurably diminished, ^{in the atmosphere of carbonic oxide, & acid} & the oxidation
 of both copper & silver prevented or ~~dimin~~ lessened

altho'

a loose black lead ring being put on the top of the crucible so that the usual commercial pigs of silver, being longer than the interior height of a pot, & projecting above it, are protected from the ~~act~~ injurious direct action of the fire. This virtual deepening of the crucible further allows full & free stirring with less danger of spitting ^{into the fire}. A piece of ~~black lead~~ ^{black iron} ~~put~~ is put at the bottom of the melting pot as a stool for the ~~large~~ ^{large} rectangular pig to stand on while melting, lest its sharp angles weight (100 lbs. more or less) should press the solid angles through the sides of the ~~crucible~~ pot.

Alloying Silver with Copper for to attain coin of 900.

① The quantity of Copper required to bring silver to standard fineness is different from that for gold. First, because, when a silver ingot is cast, the normal segregation throws a richer alloy to the center of the ingot, from which ~~part~~ the blanks are cut out, therefore the standard of ~~metal~~ ^{the} the ingot should be lower, so that the central part, ^{may be the desired} standard of 900 fineness. ^{because} Second, ^{further} in spite of all precautions, while melting, there is a tendency ~~in~~ ^{to} traces of copper to ~~volatilize~~ ^{on fire & slag off burn off} & to that limited extent to ^{raise} ~~alter~~ the standard, so that a shade more copper should be used to replace that which burns off. Third, because, in the act of cleaning blanks, to give them a pure silver surface, they are plunged while not into dilute sulphuric acid, whereby copper is ^{extracted} ~~extracted~~ from the surface, & to depth depending on the ^{strength of acid & time of immersion} ~~time they are~~ ^{remain} in the acid. I determined long ago from experience that in order to obtain ^{silver} coin of 900. we should not raise the metal above 898; but the more exact determinations ~~by~~ with Prof. R.E. Rogers proved that we should add so much copper as to bring the metal no higher than $898\frac{3}{4}$ fineness. We have followed this standard ever since with the result of fairly averaging 900 in our silver coin.

Altho
~~While~~ The stirring of standard silver is much more easy than that of gold, because it has ^{only about} ~~nearly~~ one half its specific gravity, ~~so that~~ ~~the~~ ~~so~~ so that a thorough ~~un~~ blending of the metals into a homogeneous alloy is secured, yet the strong tendency of the standard silver ^{alloy} to segregate ~~into~~ richer & poorer alloys, both in the melting pot, & in the act of congealing, demands special and watchful care, when casting standard silver ingots.

Segregation & True Assay of Silver

Altho the general fact of segregation was known long since, & ^a ~~the~~ law of distribution of poorer & richer ^{silver-copper} alloys ~~of copper~~ had been determined by the Assay Dept of this Mint, yet its importance & influence has been increasingly acknowledged up to this very year. ^{Not many} ~~Some~~ years since it ^{was} ~~was~~ ^{stet} ~~prooed~~ that the method in use up to that time of chipping off a slip from the first & last ingot of a melt for assay did not ~~yield reliable results~~ ^{give the true} ~~of the in assay of the~~ average fineness of the ~~settled~~ metal. The method was then adopted, which has ^{ever} since continued in use, of casting some of the metal into water ^(granulating) ~~at the~~ ^{when} ~~begin-~~ ning ^{to} ~~of casting~~ a melt, & just after thorough stirring, and ^{granulating} again just before finishing the casting of a melt. The uniformity in the assay ^{returns} of these two granulations ^{may be} ~~is~~ presumed to ^{determine} the true fineness of ^{all the intermediate} ~~the~~ metal. Even when this method is practised, the importance of thorough stirring was

omit?
 was clearly shown at the Annual Assay in Feb. 1877
 when the first & last granulations of melted coin, that had
 been stirred, but not enough, showed wide variations
 in the assay fineness, upon assay, ^{but after} until by remelting & thorough
 stirring, ^{nearly} they coincided.

~~Stirring Casting Silver Ingot~~ ^{Silver} ~~Stirring~~ Ingot melts. The
 above illustrates the ~~im~~ vast importance of stirring Ingot melts
 immediately before casting. It is the more important ~~less~~ at
 the present time, because most of the fine silver received from
 Refineries retains a small percentage (one or more thousandths)
 of base metal, lead, antimony, &c., which, in my view, tends
 still more strongly to induce the segregation of alloyed
~~soft~~ silver & copper into richer & poorer alloys, thereby
~~destroying~~ breaking ^{up} the legal standard. While casting a melt
 of standard silver, the stirring ^{should} ~~may~~ be continued, either ~~by~~
 directly ~~by~~ by a stirrer, or by an occasional dipping cup
 full of metal raised to a little height above the melting
 pot & poured into the latter, or lastly by thrusting the dipping
 cup into the melted metal up & down, so as to mix the metal.
 The melted metal should be disturbed continually during
 melting & casting to insure ~~the~~ the maintenance of the
 legal standard from the beginning to the end of the casting. Even

Even with the precaution of keeping the melted silver agitated to counteract segregation, we always leave a portion of silver (200 @ 300 oz.) in the melting pot for the next melt, because ~~in~~ it would take too long a time to dip out the last remnants, which ~~would~~ might induce segregation, & which would certainly expose the silver to volatilization, because the relative mass of the fire is so much greater than the small metallic residue, as to bring the latter to a volatilizing heat

~~When all the ingots of a melt have been cast~~

When cast, the silver ingots are treated similarly to the gold, dipped in dilute acid, topped, files filed on their edges & dried, with ~~only~~ this difference that only ^{ingots of the} the top layer ~~of ingots in~~ ^{or melt} a box are stamped with the number of the Melt. over

Delivery of Ingots & Receipt of Clippings

The Suptdt. ^{he} acts ~~at the~~ ^{intermediately} in transferring Ingots from the Melter & Refiner to the Coiner, & of clippings from the latter to the former, all three officers or their delegates being present at and during each transfer. The Sptdt's ~~weigh~~ ^{or} delegate weighs the bullion; each of the three deputies reads & puts down the weight; after which the weight is read ~~alt.~~ ^{aloud.}

Disagreement

Since an ingot of $898\frac{3}{4}$ ~~will~~ make coin of 900, it is ~~over~~ the
usual practice ~~not to~~ of the Assayer, not to certify to the legality of ingots
outside of 898 or 900; but it is ~~by no means~~ the standard
of nearly all fluctuates between $898\frac{1}{2}$ and $899\frac{1}{4}$ ~~will~~.

Disagreement in weights is rectified by reweighing.

Gold melts of Ingots are weighed singly; but silver melts of about 5000 oz. each.

in masses. The ~~the~~ entries in their ~~the~~ respective books consist of the date of entry, the number of the melt (if gold), the number of the draft in weighing, the description of bullion (such as clippings, or number & denomination of ingots), and their weight. At the close of the transfer, the sum of ingots & ~~weights~~ ^{of ounces} is noted by each delegate, & read aloud to clinch the accuracy of the whole transfer.

Summaries of deliveries are compared monthly or oftener.

Full receipts are given at the time of close of each delivery by the Suptdt. to the M & R. for ^{or Fine Bars} Ingots, & by the M & R. to the Suptdt. for clippings, & ~~other Bullion~~ (rarely other Bullion).

At the close of each day's work, ^{the} filings of the day ~~are~~ (gathered, & weighed, & ~~filings~~ the tops are weighed. These, ~~and~~ the tops of clippings, or other bullion, not cast into ingots, are the ingots, ~~and~~ the residue of the last melt cast into bar form, ~~are~~ all ~~these~~ separately weighed.

as against the Daily record of Melting ~~to the~~ Gold & Silver ^{to the melting room each morning}
by the M & R. & Master-melter
& Records are kept of the amount of bullion sent ~~out~~ such as the
above residues ~~at the close of each day~~ ^{of} the previous day's work, clippings
~~received~~ ^{sent} from the Suptdt., melts made up of fine metal &
with their suitable alloy, ~~and~~ ^{and} other bullion, all calculated ~~to the~~ ^{and} made up

filing benches

of the stone-floor under the iron grated floor, near the ~~melting~~ furnaces &

~~of the floor under the iron latticed~~
^{near}

At the close of day's work, the sweepings ~~of the melting room floor~~, and the slags skimmed from all the melts of the day, are put into an old melting pot, & left to ~~king~~ ^{burn} in a good fire. On the following morning the ~~flux~~ ^{slag} on the king, & the ~~ashes~~ ^{worn out pots} of the previous day, are ground & sifted in the sweep cellar, making coarse grains, & ~~finer matter~~ ^{finer} powder. This powder, when washed, yields fine grains & sweep. The king ~~with~~ is melted with the coarse & fine grains into a bar, termed ^{the} grain-bar, or ~~shorter~~, "grains", which is stamped with ~~the~~ its consecutive number from the beginning of the year, and credited to the master-melter for the previous days work. The slag from the grains ~~goes~~ ^{helps} to form a ~~general bar~~ ^{bar of grains} for the month.

^{the former of which is}
The fine grains are gathered from ~~the hopper of~~ the washing machine on the second morning after melting & dried.

At the close of ~~the~~ a month all the ^{daily} grain-bars of the month
are melted into one ^{or more} bars, called "Consolidated Grains", whose

weight & assay confirm the standard weight of the sum of
standard weights ~~of the separate bars.~~ The ^{crucibles} ~~slag~~ ^{& melting pots} from melting the grain-bars, ^{and the old melting pots} ~~are ground~~
& sifted, ^{& their grains, together with of silver} ~~of the month~~, the residues, from cleaning the dipping ingots in acid-
ulated water dilute sulphuric acid, and any other possible resi-
dues, are gathered ~~ground if necessary~~ melted at the close of the month
into one or more bars, termed General Grains. These always ~~exhibit~~
diminish materially ~~sweep~~ the apparent daily losses, which are
further reduced by the sweep & amalgam.

Sweep.

The residues, above noted as ^{finally} passing through sieves
^{in a dry state} (up to N° 60) are passed through a washer & amalgamator.
^{suspended in a constant stream of water,}
The ^{fine matter of the water, after depositing its fine grains} ~~grains~~ ^{part of}
~~from the water are taken, with the general grains,~~
the daily grains, ^{as above}

^{is forced} ~~of the daily or general grains, the finer matter is forced through~~
mercury, which takes up a ~~large~~ ^{proportion} of gold & silver.

The ^{pressed} amalgam is ^{usually} occasionally distilled, & the ~~bullion~~ ^{assayed, numbered & is} once in a
month, & its melted bar ^{numbered} named "Amalgam-bar".

The ^{fine matter} ~~sweep~~ which passes from the mercury, is Sweep, suspended

~~The amalgam is distilled once a more or occasionally,~~
& yields a bar, termed amal which ^{is} melted, is assayed,
& termed
numbered, as Amalgam-bar.

in water

in water, and flows in^{to} a settling tank, consisting of which is a wooden box, lined with sheet lead, & divided into 3 compartments by ^{partitions} ~~diaphragms~~ of sheet lead. The stream ^{first} entering one compartment, ^{into the next one} flows, through an open slit in the middle of the ^{partition} ~~diaphragm~~, through a similar slit into the ~~second~~ third, and ^{then} lastly over the top of the box, ~~at~~ which at that point is a little lower, into another settling tank below the ^{upper} ~~top~~ one, ^{from which it is drawn off clear from sediment:} ~~when~~ & lastly into deep wells. ~~The gr~~ By far larger & most valuable the ~~greater~~ part of the sweep settles in the 1st compartment of the upper vat, from which a barrel of sweep is often collected daily; while the lower vat & wells are not ^{required to be} cleaned oftener than once in the year.

There ~~is a pair~~ are two such upper vats, so arranged, that while one is ~~being~~ ^{ing} emptied, the other is filling. The ~~sweep~~

~~The dried sweep is arranged in lots of ten barrels~~

The dried sweep is first sufficient for a barrel is first ^{mingled} ~~mingled~~ by shovel on a stone floor, then again mixed by shovelling ^{more thoroughly mixed by blending by} into a large box, then ~~sifting~~ ^{from this box} into another similar box, & lastly once ^{more} mixed by transferring it to a barrel. ^{The sweep, thus} ~~Reduced, by~~ grinding, sifting, & washing, to ^{dust} ~~grains~~ of uniform size, ^{then} ~~then~~ ^{handling operations} repeated mixing becomes, by this repeated ~~mixing~~ ^{as perfectly com-} mingled, as it is possible to make a mechanical mixture; but in order to obtain, ~~a perfect if possible,~~ a still more perfect ^{of sweep is pierced through its whole depth} average for assay, each barrel ~~is supplied~~ ^{is pierced} by a hollow steel cylinder

cylinder, (like those used for flour barrels), ~~made for the purpose,~~
~~of the full length of a barrel,~~ ~~and~~ which is drawn out full
 of sweep, representing every inch in depth. Our practice is to

each barrel having been prepared & drawn
 sample ten barrels of sweep for assay in the manner just
 described, ~~each barrel~~ The ten samples are ^{averaged by} repeatedly mingling ~~by~~
~~and~~ & sifting; and the averaged assayed for gold & silver.

I have I cannot imagine a more perfect system of averaging
 sweep than this, which I introduced many years since. The assays

of sweep are made as soon as each lot of ten barrels is filled.
 The barrels are headed up and weighed, as soon as sampled.

Special Accounts.

Daily Meltings

^{This account}
~~The account of daily meltings~~ has been already described
 in detail.

Deposits

(Over)

This Month

~~Refining~~; ~~On account of the small amount of our own deposits~~
~~for Refining~~, our practice is to take ~~the~~ ^{the smaller and the smaller} gold once or twice in ~~the~~
 the month. The gold deposits are arranged in 7 ~~boxes~~ series (one or
 more boxes to each series) according to their hundredths of assay
 fineness, from .300 to .900, those below ^{.400} ~~.399~~ in ~~the~~ one lot, called
 the .300 series, ~~the~~ (or 3rd box), those ~~below~~ from .400 to .499 in
 the 4th box; &c, &c, ~~those~~ ^{the} deposits derived from ^{good} coin being
 reserved for melting only. So much gold of each box is taken
 as will make 2400 oz., or a melt for granulation, when
^{calculated}
 the quantity of silver is added to it, to make the ratio

Refining Account

~~Refining of~~ The large Gold & Silver deposits are taken by the Mr. & R. in quantities by themselves, ~~the sum the smaller every day~~ as soon as practical ~~after their assay & the calculation of~~ ~~or two~~ and all ~~as soon as after they are assayed & their value~~ from weight ~~ascertained~~. A receipt is on each occasion given for the gross weight received. They are separated ~~into~~ those of standard fineness from melting coin, ~~those~~ to be simply melted again into standard Ingots for coin; — 2 into fine bars, to receive their due proportion of copper alloy, & to be made directly into coin-ingots; — ^{3.} and into those requiring to be refined by acids, ~~If either~~ hard or brittle, they are toughened by fluxing in the melting pots. If any lots of No 1 or 2 be

The two former classes are embraced in the Account of Daily Workings;

the last ~~are embraced in the Refining Account.~~

quantity of Gold & Silver (or base metal) in the ~~The gold deposits are calculated, & so much silver (whether~~ base or fine, is not essential) added, that the ratio between pure gold & silver (~~including~~ ^{with it} base metal) shall be about 1 : 2 ^{about}. The ^{usual} melt of 2400 oz. therefore consists of 1600 oz. of pure gold, & 1600 oz. of silver, &c. After melting & thorough stirring, the alloy is dipped out, & cast ~~at~~ from the height of several feet by a gyratory motion into very cold water, the object of such granulation being to present as large a surface as possible to the subsequent action of pure nitric acid, of 35° @ 40° Beaumée. The granulations are ~~put in~~ ^{steamed in} 20 gal. porcelain pots, ~~in~~ ^{contained in} pure nitric acid of 35° @ 40° Beaumée ~~being poured over them~~, the unsaturated acid of the previous operation ~~is~~ ^{being economically} added as part of the charge. ^{from} The undissolved residue of tolerably fine gold, (The solution of nitrate of silver is drawn off ~~for~~ which is washed with water, and the silver recovered from the nitrate solution by common salt

~~over~~
~~between gold & silver, 1:1 (approximately). Of course~~
~~the silver deposits containing gold are employed instead~~
~~of silver alone, as far as practicable.~~

~~a debit account.~~ ^{against the Refinery}
~~An exact account is kept of all the gold and silver~~
~~sent into it, each bar (lot or bar, however small, being entered separately~~
~~used for refining, reduced to standard weight, after~~
~~in gross weight, fineness, & standard weight.~~

~~the refining is completed, all the refined in The Refinery~~
~~is credited with all gold & silver, refined & melted, which~~
~~it returns to the Vault, in the form of bars, grains, &c.; and~~
~~a balance is struck between the two sides. As a general rule~~
~~the loss is very small; where it is larger, it is minutely inves-~~
~~tigated ~~to deter~~ until the cause of the apparent or real loss is~~
~~ascertained.~~

Vault Account

~~An~~ special account is kept, ^{the Vault is debited with} in which all the bullion;
 put into ~~the vault is deb~~ it, and credited with all
 taken out, the gold & silver being kept ⁱⁿ separate accounts.

The different objects of ~~the account~~ are classed together
 according to their nature, such as fine ~~silver~~ bullion,
 clippings, grain bars, deposits, &c. each of which con-
 stitutes an account by itself, & additions are made ^{to it} or figures
 cancelled, as the case may be. ~~Where constant frequent~~
~~changes are going on, we cannot at any moment~~ ^{The accounts}

by common salt solution, as chloride, which is reduced to metallic silver by granulated zinc, thorough washing, pressing dry, & melting.

The gold residue is treated by hot sulphuric acid in iron pans ~~at~~ by two successive charges, so that when the acid is poured off, & the gold washed ^{pressed} & melted, it exhibits a fineness of 998@999.

Pressing and Drying reduced gold & silver is resorted to save loss, ~~by mechanical dusting in the fire~~, for if the ~~now~~ refined & powdered metal be put into the melting pot without pressing & drying, it boils in it, often violently, from the escape of steam, & the fine particles are carried ^{with the vapor} into the chimney, & some of them ^{escaping} out of the top. The reduced metal, after ^{washing by litmus paper &} ~~pressing~~ simple drainage, is pressed into cakes, which in silver weigh about 40 lbs. ^{each} by a powerful hydraulic press; and these solid cakes are dried on iron pans at a low red heat. When the broken cakes are now melted in the pot, not the slightest ebullition is perceptible, & the refining accounts show that ~~there is no ap-~~ ~~preciable~~ loss, is quite inconsiderable.

Instead of granulating we sometimes melt the gold with ~~in the ratio of 4:~~ silver in the ratio of ~~1:1.3~~ $1:2\frac{1}{3}$, cast them into 12@15 lb. bars, ~~which~~ and treat them in like manner with ~~oil of vitriol~~ nitric acid & oil of vitriol.

The accounts are always left open, because of the frequent daily changes in the contents of the vault, ~~but it~~ ^{but} it would require only a few minutes' time to ~~tell the~~ ~~and~~ determine the whole amount in the vault. For the same reason, of constant changes, the account is only kept in gross, & not calculated to standard weights, but as the finenesses are either entered in the account, or easily obtainable from other ~~accounts~~ sources, ~~a short~~ the whole could be reduced to standard weights in a short time. ^{To} ~~The manner~~ Each bar, ~~or melt, or lot,~~ ^{entered on the} ~~is entered by set down put down~~ in the vault book is set down ^{the} ~~by~~ date of entry, ~~the~~ number of bar, &c., ~~the~~ description, gross weight, fineness in gold and silver, and date of removal.